3.0 THE RECOMMENDED PROCESS FOR FLOW MANAGEMENT ISSUE RESOLUTION

This section presents the recommended process for resolving interstate flow management issues. HydroLogics considers the adoption of a consensus-building process, using the best available information and analytical tools, to be the critical component of the recommended strategy for resolving flow management issues. For clarity, the process is presented before the specific issues and technical recommendations, which are presented in Section 4. The process and technical components of the strategy are interdependent.

Adoption of an "open" or "transparent" water resources planning process – a procedure followed by the Commission in the development of a new Basin Plan for the Delaware River Basin – is believed necessary in the resolution of flow management issues. A consensus approach is recommended not only for making final decisions but also for developing the means to reach a final decision, including the selection or development of the information and tools. It is HydroLogics' view that if stakeholders have no say in, for example, planning field studies or developing models, it will be difficult to convince them of the merit of decisions arising from the information gained. Such open approaches are being adopted with increasing frequency in hydroelectric project licensing under the jurisdiction of the Federal Energy Regulatory Commission and in other forums dealing with the allocation of water resources.

In the Delaware River Basin, the DRBC Compact requires unanimous approval of the Decree Parties for flow management policy changes that modify the 1954 Supreme Court Amended Decree. While the Decree Parties consider the inputs of many interests, these interests do not have decision-making authority. Opportunities for outside interest group participation are provided through public meetings of the Flow Management Technical Advisory Committee and the Commission.

3.1 <u>Recommended Process for Resolving Interstate Flow Management Issues</u>

The process proposed below is presented as a means to help resolve water management issues by reaching stakeholder consensus on flow management alternatives, policies, and solutions. It is the framework into which the technical recommendations for the development of flow relationships fit. While adoption of and adherence to the proposed process does not guarantee that every issue will be resolved to the complete satisfaction of all parties, HydroLogics' experience has shown that similar processes elicit respectful and committed participation from most stakeholders and maximize the chances for success.

That proposed process consists of the following steps:

1) Identify issues and index displays (also called performance measures) that reflect the relationship between flow and user benefits for a given issue. This must be done as an inclusive activity involving all stakeholders.

2) Identify the data and scientific methods needed to evaluate alternative management policies in terms of the displays, and obtain stakeholder consensus on using those data and methods. The analytical tools selected must be capable of evaluating all of the likely alternatives in an efficient and scientifically defensible manner.

3) Obtain the data and analytical tools needed to develop currently unquantified flow relationships as well as tools capable of evaluating the costs and benefits of alternatives.

4) Develop a representative set of alternatives to be evaluated.

5) Provide all stakeholders access to the flow relationships and analytical tools.

6) Use the tools to focus negotiations on promising alternatives.

This study has initiated several of the steps in the above recommended process. For Step 1, issues have been identified and performance measures have been suggested; for Step 2, a new daily flow and reservoir operations model, OASIS, has been developed for the analysis of alternatives and the development of additional models has been recommended; for Step 3, technical recommendations for developing flow relationships have been made and GIS data useful in presenting and evaluating alternatives have been assembled.

HydroLogics recommends that the process, once established, be maintained through the periodic review and revision of performance measures and associated analytical tools and expanded through the use of forecasting tools to support the adaptive management of water resources.

3.1.1 Review and Revise the Tools and Performance Measures on a Periodic Basis

Very few institutional processes can be static and remain relevant over the long term. The following actions are suggested to keep the process current:

1) Review the adequacy of all analytical techniques on a periodic basis.

   The DRBC should schedule regular internal (more frequent) and external (less frequent) reviews of its analytical tools, and upgrade them as stakeholder concerns and political and legal realities dictate, and as funding and time permit.

2) Review performance measures through advisory committees.

   We suggest that the DRBC periodically convene a "State of the River" conference. At the conference, stakeholders would be invited to share their concerns and suggest new issues, index displays, and analytical improvements that would be helpful in assuring that the tools and process remain up to date. Such a conference might alert DRBC to emerging issues so that the tools can be upgraded to deal with those issues.

3.1.2 Develop Monitoring and Forecasting Capabilities to Support Adaptive Management

As used in this report, adaptive management is a process through which management strategies change in response to changes in the state of the water resources system, new scientific understanding of how management actions affect the system, and changes in management objectives. Clearly, implementing an adaptive management strategy requires monitoring and forecasting of the things that might cause the management strategy to change - the state of the system, the progress of related science, and the management objectives. Unfortunately, monitoring is an often overlooked part of the process, even though without monitoring, adaptive management cannot be effective.

Forecasting tools predict the future state of the water resources system, and thus may be an important part of an adaptive management strategy. Using forecasting tools as a part of a management strategy broadens the range of alternatives, and may dramatically improve the ability to manage for important objectives. HydroLogics suggests that DRBC work with the National Weather Service to apply products from the Advanced Hydrologic Prediction System (AHPS) (e.g., the River Forecast System and its Extended Streamflow Prediction component) to flow management.

3.1.3 The Concepts of Flow Relationships, Performance Criteria, and Index Displays

The recommendations of this report are centered on the development and use of flow relationships and the identification of performance criteria so that index displays can be prepared to allow operating alternatives to be evaluated in terms that are as explicit and objective as possible.

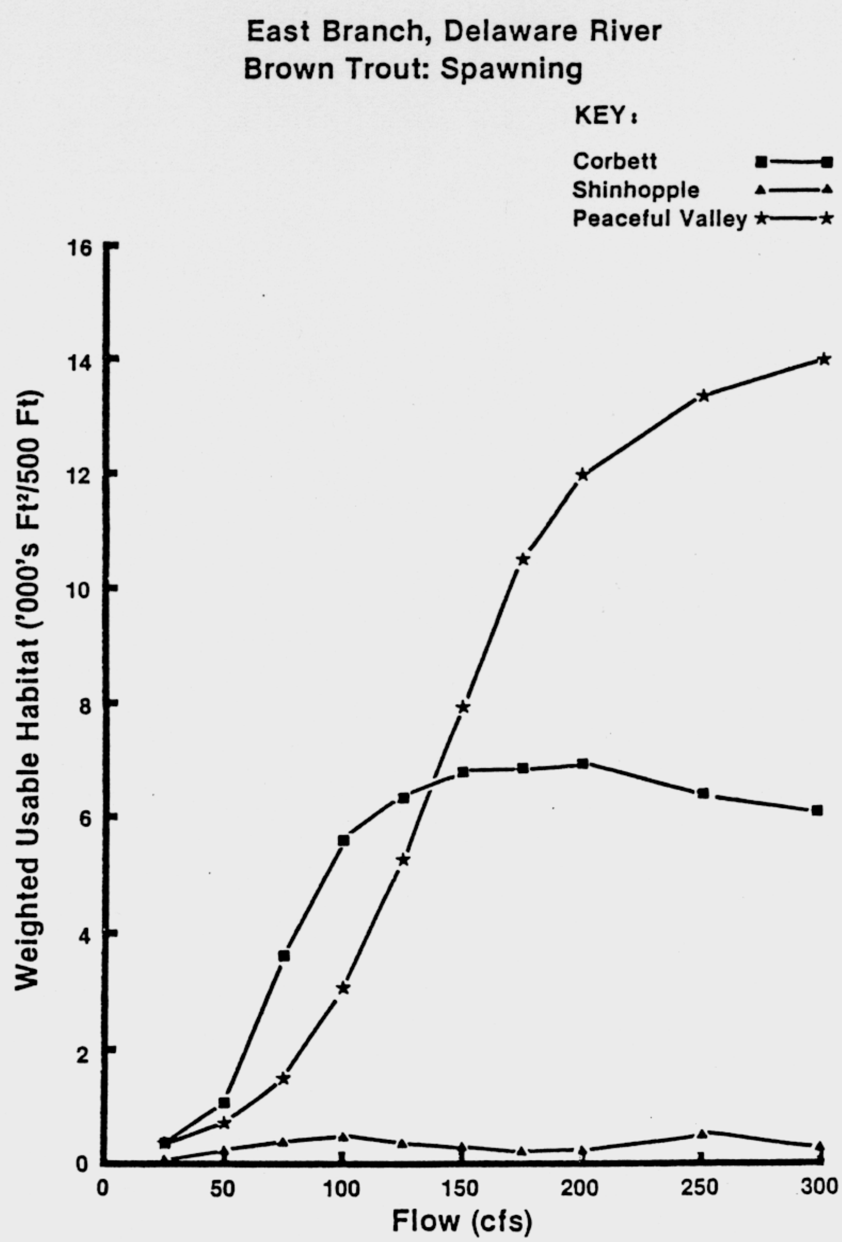
In this report, the term index display refers to a means of gaging the performance of a particular operating scenario against an explicit criterion. An example of such a display might be a flow hydrograph on to which a horizontal line that defines minimum acceptable flows for fish habitat is superimposed. In order to develop such a display, the underlying relationships between flow and fish habitat must be understood, which may require data collection, analysis, and modeling. Once the flow relationship is understood, the flow that is “acceptable” must be defined for the various interest groups participating in the negotiation process. It is likely that not all parties in a negotiation will have the same definition of this condition, so the flow relationship is important to allow tradeoffs that must be made among competing water uses. The more scientifically defensible the flow relationship and the performance criterion are, the more meaning they have as an objective, physical measure of water resources evaluation.

An example of the development of cold water fisheries flow relationships and a recommended performance criterion is provided by NYSDEC Technical Report 83-5 (Sheppard, 1983). A number of the recommended flow criteria continue to be considered (as of May 2003) in negotiations between NYSDEC and NYCDEP over modifications to the existing fisheries release program.

Figures 3.1 thru 3.4 show the set of flow versus habitat curves developed for four life stages of brown trout at several locations along the East Branch of the Delaware. The life stages include spawning, fry, juvenile, and adult. Similar sets of curves were developed for the West Branch of the Delaware and the Neversink. These curves relate to the wetted area and depth of fishery habitat and not to water temperature, which must be considered separately.

After evaluation of these flow relationships for each of the stream segments, the NYSDEC recommended a set of flow criteria for the East Branch at Harvard of 175 cfs during normal conditions, 125 cfs during *drought warning* (there was no *drought watch* stage at that time), and 100 cfs during drought. These recommendations are not to be confused with any more recent recommendations and are presented here for example purposes only.

When this type of scientifically derived information is combined with flow modeling (such as that provided by the DRBC OASIS model), reservoir operating scenarios can be evaluated in terms of index displays which might show the flow hydrograph for a given period and the success of meeting the flow criteria, or graphs or tables showing the number of days above or below the criteria. Again, the value of the flow relationship is that it defines the basis for the flow criteria and the basis for evaluating the impacts of compromises that may be made during the negotiation process.



Changes in weighted usable brown trout spawning habitat with flow at the Corbett (4.6 miles), Shinhopple (8.0 miles) and Peaceful Valley (9.0 miles) study reaches on the East Branch, Delaware River downstream of Pepacton Reservoir.

Figure 3.1 Habitat Curve for Spawning Brown Trout (NYSDEC Technical Report 83-5)

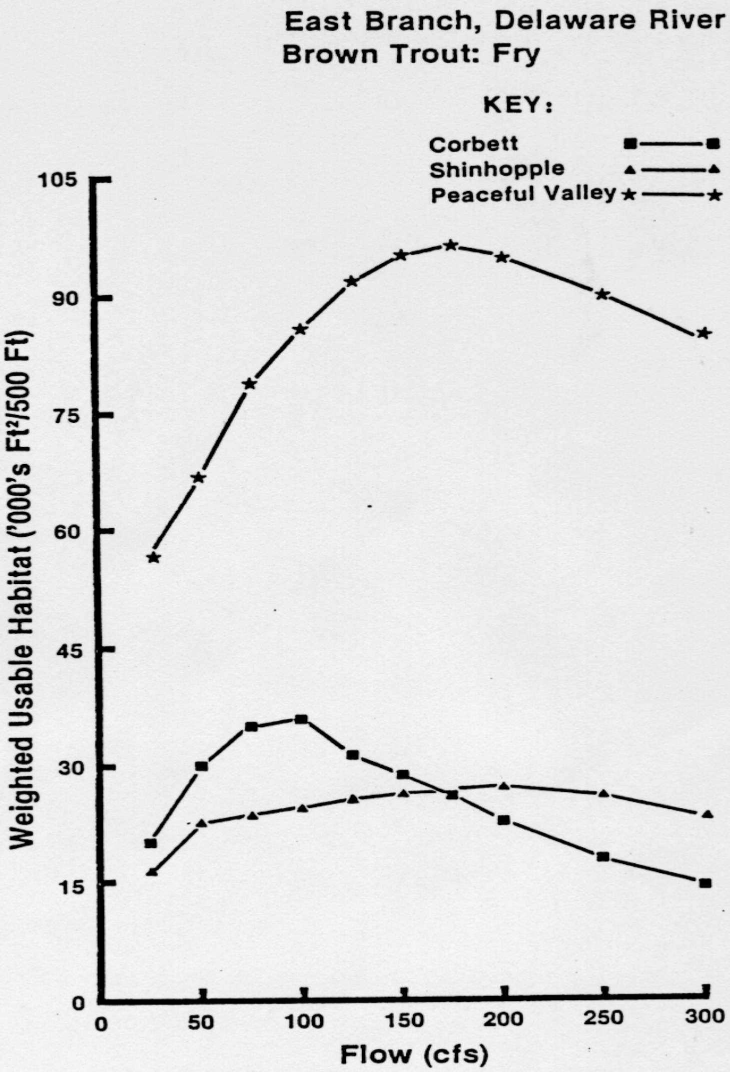


Figure 19. Changes in weighted usable brown trout fry habitat with flow at the Corbett (4.6 miles), Shinhopple (8.0 miles) and Peaceful Valley (9.0 miles) study reaches on the East Branch, Delaware River downstream of Pepacton Reservoir.

Figure 3.2: Habitat Curve for Brown Trout Fry
(Reference, NYSDEC Technical Report 83-5)

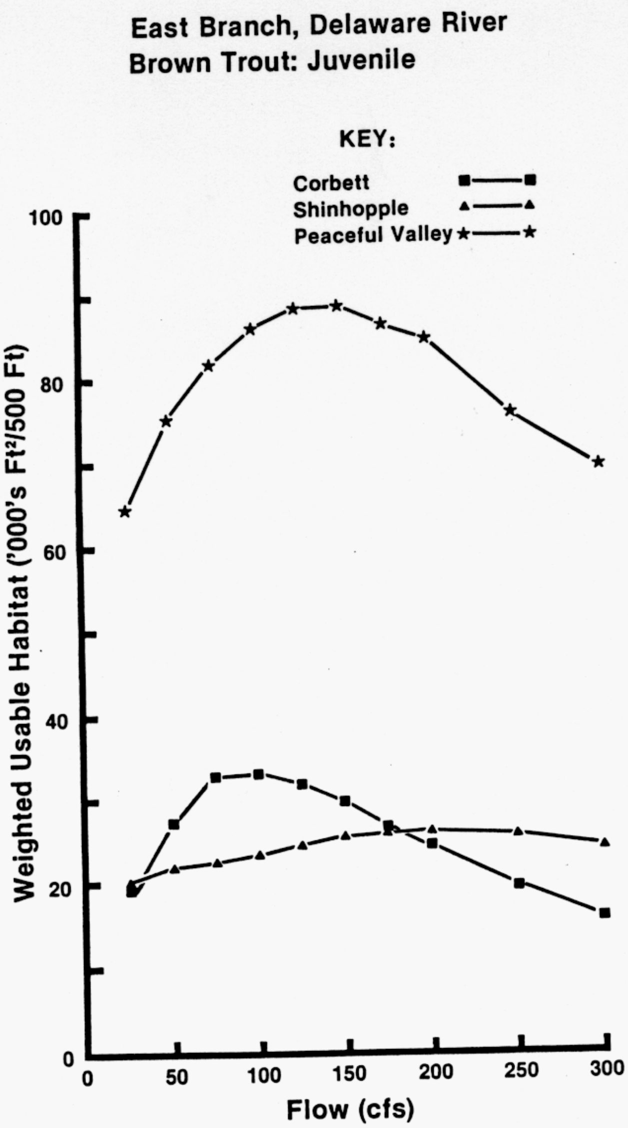


Figure 20. Changes in weighted usable juvenile brown trout habitat with flow at the Corbett (4.6 miles) Shinhopple (8.0 miles) and Peaceful Valley (9.0 miles) study reaches on the East Branch, Delaware River downstream of Pepacton Reservoir.

Figure 3.3: Habitat Curve for Juvenile Brown Trout (Reference: NYSDEC Technical Report 83-5)

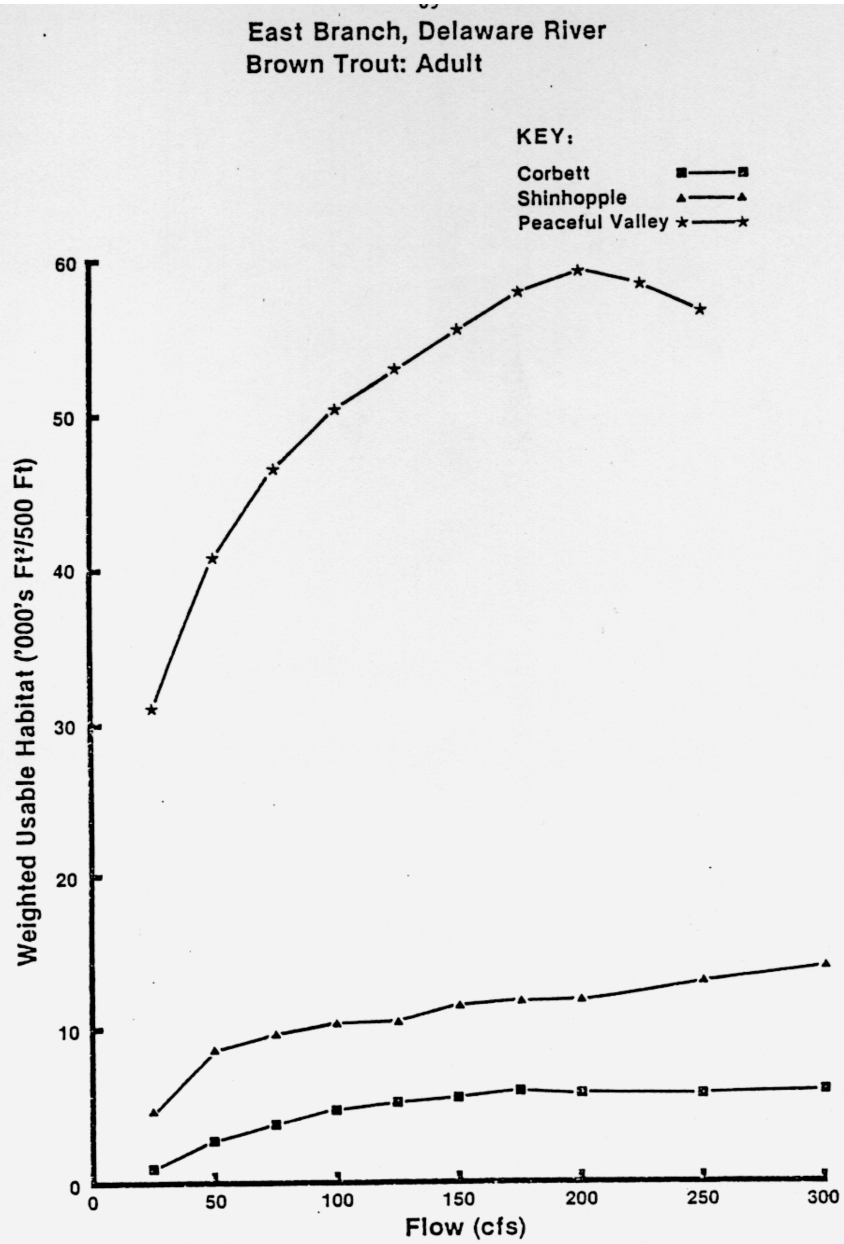


Figure 21. Changes in weighted usable adult brown trout habitat with flow at the Corbett (4.6 miles), Shinhopple (8.0 miles) and Peaceful Valley (9.0 miles) study reaches on the East Branch, Delaware River downstream of Pepacton Reservoir.

Figure 3.4: Habitat Curve for Adult Brown Trout (Reference: NYSDEC Technical Report 83-5)